

What Is Claimed Is:

1. A piezoelectric transducer apparatus comprising:

at least one piezoelectric unit each having a piezoelectric block and at least
5 one pair of electrodes, first electrode of said at least one pair of electrodes being
adhered to a first surface of said piezoelectric block, and second electrode of said
at least one pair of electrodes being adhered to a second surface of said
piezoelectric block opposite to said first surface of said piezoelectric block; and
a body structure, each of said at least one piezoelectric unit being adhered to
10 the surface of said body structure with one of said at least one pair of electrodes
exposed externally, electrode shape of said exposed electrode of each of said at
least one piezoelectric unit being matched to a desired body strain pattern existing
in said body structure wherein said electrode of each of said at least one
piezoelectric unit exciting a strain pattern in said body structure that is the same as
15 said desired body strain pattern.

2. A piezoelectric transducer apparatus comprising:

at least one piezoelectric unit each having a piezoelectric block, a first
electrode and a second electrode having an electrode shape, said first electrode
being adhered to a first surface of said piezoelectric block, and said second
electrode being adhered to a second surface of said piezoelectric block opposite to
said first surface of said piezoelectric block; and
a body structure, each of said at least one piezoelectric unit being adhered to
the surface of said body structure with said first electrode exposed externally, said
25 electrode shape of said first and second electrodes of each of said at least one
piezoelectric unit being matched to a desired body strain pattern existing in said
body structure wherein said first electrode of each of said at least one piezoelectric
unit exciting a strain pattern in said body structure that is the same as said desired
body strain pattern.

3. The apparatus of claim 2, wherein said body structure is an elongated rod having an arbitrary cross-sectional shape.

5 4. The apparatus of claim 3, wherein said strain pattern in said body structure is related to vibration in the longitudinal direction of said body structure.

10 5. The apparatus of claim 3, wherein said electrode shape is an exponential function of the longitudinal dimensional variable of said elongated rod.

15 6. The apparatus of claim 3, wherein said electrode shape is an exponential function of the superposition of at least two exponential functions.

7. The apparatus of claim 3, wherein said electrode shape is a trigonometric function of the longitudinal dimensional variable of said elongated rod.

20 8. The apparatus of claim 3, wherein said electrode shape is a trigonometric function of the superposition of at least two trigonometric functions.

9. The apparatus of claim 3, wherein the first end of said elongated rod is supported and the second end of said elongated rod is free from any support.

25 10. The apparatus of claim 2, wherein said body structure is an elongated shaft having a circular cross section.

11. The apparatus of claim 10, wherein said strain pattern in said body structure is related to torsional vibration in directions perpendicular to the longitudinal direction of said body structure.

12. The apparatus of claim 10, wherein said electrode shape is an exponential function of the longitudinal dimensional variable of said elongated rod.

13. The apparatus of claim 10, wherein said electrode shape is an exponential function of the superposition of at least two exponential functions.

14. The apparatus of claim 10, wherein said electrode shape is a trigonometric function of the longitudinal dimensional variable of said elongated rod.

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15. The apparatus of claim 10, wherein said electrode shape is an trigonometric function of the superposition of at least two trigonometric functions.

16. The apparatus of claim 10, wherein the first end of said elongated rod is supported and the second end of said elongated rod is free from any support.

17. The apparatus of claim 2, wherein said body structure is a structure complying to a second order analytical system.